BEHR GmbH & Co. KG
Mauserstraße 3, 70469 Stuttgart

Component, especially a hybrid carrier for a vehicle, and method for the production of said type of component, and use of said type of component

The invention relates to a component, especially a hybrid carrier for a vehicle. The invention also relates to the production and use of a component of this kind.

Already familiar from the automobile construction industry are transverse carriers formed from tubes, which consist of metal and exhibit appropriately heavy wall thicknesses. The wall thicknesses in this case are of appropriately heavy execution for adequate dimensional, bending, bursting and torsional stability and for adequate load-bearing capacity. The transverse carrier executed as a tubular or hollow profile is suitable in principle for guiding air, for example from an air conditioning system arranged centrally in the front area of the vehicle, to lateral discharge outlets.

The stipulated rigidity of the component, in particular the carrier and a cross section resulting therefrom, leads to a correspondingly high weight of the component. In addition, the space required for installation is large, while the space available for installation is restricted by the body of the vehicle. A reduction in the size of the component would involve a reduction in the size of the channel cross section, which, although associated with a reduction in weight,

nevertheless causes an increase in the flow velocity. This would lead to increased noise generation and to an associated impairment of comfort.

Moreover, the cost of logistics and production of the component with an air channel is high, because prefabricated blow-molded or injection-molded parts are involved. In the event of accidents involving impact by the head, costly safety measures are also required, which call for the lowering of the outlet nozzles from the air channel, for example.

DE 100 64 522 A1 describes a component, especially a transverse carrier intended to be arranged between the A-pillars of a motor vehicle, having an essentially tubular base body, in which at least one channel is provided, in conjunction with which the base body is lined internally with plastic to form channel walls consisting of plastic. The component in this case is covered with plastic by an injection or molding process, in conjunction with which this forms channel walls. A process of this kind requires a large number of working operations and is thus associated with a high production cost. This component also exhibits a high weight.

Previously disclosed in DE 200 21 556 U1 is an airtight hose made from a flexible material used as a fluid or flow channel. A hose of this kind can also be connected by gluing or welding, which is a very intricate operation if accurate positioning is to be achieved, in view of the small space that is available for installation. Here, too, the simultaneous conveyance of several fluids is not possible.

The object of the invention is thus to make available a component of particularly simple construction, which is especially suitable for a channel for a medium, for

example air. A particularly simple process for producing the component and uses for the component are described in addition.

The object is achieved in accordance with the invention with regard to the component by the characterizing features of claim 1. With regard to the process, the object is achieved by the characterizing features of claim 17, and with regard to the uses for a component of this kind, the object is achieved by the characterizing features of claims 30 to 32.

Advantageous further developments of the invention are the subject of the dependent claims.

The invention in this case is based on the notion that a component, in particular a hybrid component used as a carrier and intended for the distribution of air in the interior of a vehicle, should be simplified in such a way as to afford particularly simple production and easy replacement, and in such a way as to provide an air-guiding channel offering a significant reduction in the weight of the component. In addition to the simplification of the channel, the weight in particular should also be significantly reduced. For this purpose, the base body of the component exhibiting a cavity is provided at least in some areas with a plastic lining situated at least internally and/or is executed with perforations at least in some areas. In order to achieve the greatest possible reduction in weight, the plastic lining is formed by a film channel made of plastic arranged in the cavity of the base body.

The base body is made appropriately from at least two elements, for example a half shell with a lid or two half shells. With the component in its closed state, a flow channel, in particular an air-guiding channel, is formed in a simple manner by the cavity in the closed

base body and the film channel arranged therein. The base body is executed from a metal, a light metal or its alloys, in particular from aluminum, magnesium, titanium or refined steel, and exhibits a wall thickness from 0.4 mm up to 2.0 mm or even up to 3.0 mm, and in particular from 0.7 mm up to 1.2 mm. The wall thickness in this case can remain largely constant, however, or may vary in the longitudinal and/or transverse extent of the base body depending on the strength or rigidity requirements. With a thin-walled metal base body of this kind consisting of a plurality of elements, for example half shells, and a film channel made of plastic, it is possible to replace the customary thick, compact walls of a hybrid carrier with a thin, compact wall with an easily applied lightweight insulation. The hybrid carrier in its entirety is significantly lighter in weight and can be produced at a lower cost. In conjunction with this, a film channel can be used at the same time for a plurality of, or for all the outflow points, whereby a delayed use of the film channel for the conveyance of different fluids to different outflow points is also possible. In the event of deformation, the discharge nozzles can retract into the film channel or the film channels, in conjunction with which the film channel, which is made in particular from a plastic film, will offer only little resistance. In addition, the base body made from sheet metal half shells with low wall thickness contributes to the high stability of the component.

The film channel is preferably made from a thermoplastic material, in particular polyethylene plastic or polypropylene plastic. For example, the film channel can be formed and produced from a plastic material that has been foamed and extruded by physical or chemical means, in particular in a single layer or in multiple layers. In one preferred embodiment, for

example, a foam film made of polypropylene or polyethylene can be provided. The plastic in this case is preferably foamed and extruded, as a result of which a smaller thickness with a high load-bearing capacity is achieved. Alternatively, the film channel can be executed from a compact film provided, where appropriate, with a woven fabric made from plastic fibers or metal fibers. Examples of this are films made of polyvinyl chloride, polypropylene, polyethylene, thermoplastic polyolefin and thermoplastic polyurethane. The use of a compact plastic film of this kind permits a small film thickness in conjunction with high stability and rigidity, in particular resistance to bursting. A very low weight for the film channel can be achieved with polyethylene or polypropylene plastic.

The use of such materials for the film channel permits the selection of acoustic and/or thermal characteristics, such as acoustically and or thermally insulated characteristics, as required, for example in sections, by executing the layer construction of the plastic used for the film channel accordingly. The film channel preferably exhibits a channel wall with an ultimate tensile strength of at least 1 bar positive pressure and a temperature resistance of 85°C to at least 120°C. It is possible in this way to ensure that the film channel remains dimensionally stable and functionally stable, both in the presence of positive pressure, for example with the outflow nozzles of the flow channel closed and with the fan switched on, and in the presence of particularly high thermal loadings, for example due to solar radiation.

In one possible embodiment, the film channel exhibits a wall thickness from 0.2 mm to 0.5 mm and a density of the plastic from 60 g/l to 200 g/l or 300 g/l. In this case, the film channel exhibits a stable wall structure. For example, the skin or the deformable

material is executed with corresponding flexibility, and in particular elasticity, so that wrinkling is reliably avoided and with it adhesion of the channel wall of the film channel. At the same time, the generation of noise is suppressed and the traveling comfort is increased accordingly by the use of an elastic, in particular rubber-like material with particularly good acoustic damping characteristics.

In one simple embodiment, the film channel is formed from at least two layers of plastic or plastic films, which are superimposed as far as possible one on top of the other to form a cavity. The film channel is expediently attached in a thermally adhesive fashion and/or by bonding to the base body, and in particular to its inner wall. Alternatively or additionally, the film channel can be retained on the base body by securing elements.

In order to execute the flow channel as a so-called multiple-chamber channel, the film channel is provided with a partition wall, in particular an elastic, formable and/or folding partition wall. Variable cross sections can be set for the individual channels of the chamber by means of a flexibly formable partition wall of this kind. The partition wall in this case can be formed by a separate plastic film, which is arranged between the two layers of plastic of the film channel. By using a plurality of chamber channels, which are separated from one another in each case by at least one partition wall in the form of a plastic film, different flow media, for example warm air, cold air, fresh air, can be conducted to different outflow points.

Alternatively or additionally to the partition wall, for the purpose of forming a multiple-chamber channel in the base body, the film channel can exhibit a smaller cross section than the cross section of the

base body. At least one two-chamber channel can be formed by the appropriate arrangement of the film channel with a smaller cross section. For this purpose, the film channel makes contact with at least one internal wall of the base body. More than two chamber channels can be formed in the case of an arrangement of the film channel without making contact with the base body. An additional partition wall or separating film can be dispensed with.

For the best possible rigidity, in particular resistance to bursting, buckling and/or torsional stability of the base body, this can also be lined on its inner wall, at least in parts, with plastic applied by spraying. Additional insulation and/or improved force transmission and force stability are achieved in this way.

Furthermore, the film channel can be provided with reinforcing elements, for example ribs or burls, on its outer side facing towards the base body. In this way, the film channel has a greater load-carrying capacity and is of more stable execution.

In a further embodiment, a plurality of film channels can be arranged in the base body. These can be assembled inside one another or adjacent to one another, for example, to form a multiple-chamber channel. In this way, the insulation of the channel and the chambers can be improved in relation to one another. Additionally or alternatively, in the case of a flexible film channel, its surface can be provided with a structure which prevents adhesion of the channel walls.

In a further embodiment, the film channel can be executed, instead of as a blown film, as at least two deep-drawn half shells, which are arranged one above

the other to form the film channel. The deep-drawn half shells are made from compact plastic of a similar kind to the plastic used in a box of chocolates, for example, and exhibit sufficiently good inherent stability and inherent strength.

Various methods are available for the simple forming and introduction of the film channel.

For example, the film channel made of plastic may be introduced into a cavity in the base body, in particular by mechanical and/or thermal means with or without the use of pressure.

In conjunction with this, the film body can be assembled in the base body itself. Alternatively, the film channel can be pre-assembled in a separate forming tool and then introduced into the base body.

In one possible production process, at least two layers of plastic are arranged one on top of the other and are attached to one another at their lateral edges running in a longitudinal direction, in particular by compression or welding. Instead of two flat layers or films of plastic, a simple blown film which initially lies flat can also be used, which is also attached at two edges. Following thermal preheating, the edges are then pushed together so as to cause the two layers or films of plastic to arch outwards in mutually opposing directions or the blown film to arch outwards. This process is also known as the so-called "Twin Sheet Process". Alternatively or additionally, outward arching of the two layers of plastic can be achieved by shortening spring elements applied to the outside of the layer of plastic in each case.

The arching apart of the layers of plastic can thus be performed very easily and efficiently in a variety of

ways: for example, by causing the compressed edges to slide towards one another, or by allowing warm air to flow in between at least two layers or to be introduced into a single blown film lying flat, until the layers or the blown film arch outwards and become attached to the internal wall of the base body or the forming tool (= restriction).

The arching process will be easier and more precise if air is led away via at least one recess in the base body or the forming tool. Alternatively or additionally, arching outwards can be caused to take place outside the recess in the base body or the forming tool by the application of a negative pressure, in conjunction with which the precision is increased if the expansion of the plastic layers or the blown plastic film is restricted to the recesses.

Depending on the production process, and the nature of the plastic used, the layer of plastic in the outward-curved state may harden and form the film channel, in conjunction with which this may lead to adhesion at points of contact with the internal wall of the base body. In the case of an essentially flexible and soft plastic, this will adhere to the internal wall of the base body in such a way that the film channel is formed.

In an alternative embodiment, the film channel is produced from at least two deep-drawn half shells, which are introduced into the base body. Depending on the production process, the base body in this case is used as a forming tool to produce the two deep-drawn half shells. In this case, the film channel is formed from at least two deep-drawn plastic layers or plastic films inserted into at least one element of the base body and secured there. Furthermore, at least one additional plastic layer or plastic film can be applied

between inserted, deep-drawn half shells, thereby enabling a division of the film channel into two chamber channels, in which various fluids, for example fresh air or warm air, can be conveyed at the same time. By the additional application of at least two flat plastic films between inserted, deep-drawn half shells, between which at least one outward curve is produced by means of the inward flow of warm air, it is possible to produce a film channel with three or more chamber channels by simple means.

In addition to the self-adhesion of the film channel to the base body, the film channel can be retained on the base body by means of a securing element. An additional attachment of the film channel to at least one element of the base body increases the stability, in particular in respect of displacements of the film channel in relation to the base body in service as a flow channel.

In order to achieve the best possible supporting structure and supporting construction of the component, the base body can be coated additionally by the plastic, at least partially and in particular along its longitudinal extent, and in particular extrusion-coated. The base body is preferably provided with plastic internally and/or externally. The plastic is also preferably applied in one or more layers and/or with a thickness that varies in different areas. In order to achieve the best possible bending, buckling and torsional stability of the component, the plastic should preferably be applied with positive engagement and over the entire surface. In addition to providing good structural rigidity, the plastic layer also offers thermal insulation and/or acoustic insulation in a plastic structure that is executed as a channel, through which a medium flows in the form of a gas or a liquid. In addition, one of the layers of plastic can be provided with a reinforcement, and in particular

with a reinforcing woven fabric, with fibers, spheres or other materials, for example a fiberglass cloth. For better thermal and acoustic insulation, the layer of plastic can be executed as a foam. PU foam, hard or soft foam, integral foam, can be caused to foam by physical or chemical means for this purpose (TSG thermoplastic foam extrusion molding, Mucell process, etc.), or can be applied in a multiple-layer form, in conjunction with which individual layers can exhibit different thicknesses.

A base body executed from a metal or a light metal, in particular aluminum, magnesium or refined steel, with a wall thickness from 0.4 mm to 1.5 mm, to 2.0 mm or even to 3.0 mm is preferably used. Depending on the nature and the function of the component, the base body can be formed with a varying wall thickness in different areas. For example, in the event that the component is used as a transverse member, this can be executed with a greater wall thickness in the vicinity of mountings and force application points in the vehicle, for example in the vicinity of a connection to an A-pillar, in the vicinity of the steering, in the area of the connection of an air conditioning system, or, in the case of so-called front-end structural members, in the vicinity of the longitudinal members, engine mountings or the bonnet lock, than in the area in which the component serves only as an air channel, as an assembly support or for other functions. The metal sheets used for the base body are available under the designations "tailored blanks" (assembled by welding in certain areas), "tailored rolled blanks" (rolled with a different thickness in the direction of rolling), "profiled strip" (e.g. thick edge, thin center), or as "patch-work sheets" (as in a puzzle, although each part attached to the blank has a different wall thickness). A metal base body of this kind or a sheet component of this kind is particularly economical and is

particularly suitable for use in the automobile construction industry in a lightweight assembly designed to achieve a reduction in weight.

The component described above is preferably used as an instrument panel carrier in a vehicle, in conjunction with which the plastic core or the plastic structure forms one or more channels, in particular an air-guiding channel and/or a cable channel. Alternatively, a component of this kind can be used as a transverse carrier in a vehicle, in particular as a transverse carrier between the A-pillars of a vehicle.

The advantages achieved with the invention are in particular that, by means of a base body with a film channel, an essentially lightweight component with a particularly small installation volume is obtained. In addition, the component can be produced with a particularly simple forming tool. A component is thus particularly cost-advantageous as an air-guiding channel due to the low material and component costs. The component also has a particularly low weight. Various flow channels are possible through the flexible design of the film channel.

Illustrative embodiments of the invention are explained in more detail with reference to a drawing, in which:

Fig. 1 illustrates schematically an overall view of a component, in particular a hybrid carrier;

Figs. 2A to 2D illustrate schematically the production of a component with a film channel as a cross section in a forming tool;

Figs. 3A to 3B illustrate schematically the insertion of a film channel into a base body of a

component as a cross section;

Figs. 4A to 4C illustrate schematically the production and arrangement of a film channel in a base body of a component as a cross section;

Figs. 5A to 5B illustrate schematically two components, in particular hybrid carriers with a film channel as two chamber channels as a cross section.

Corresponding component parts are provided with identical designations in all the Figures.

Represented in perspective view in Figure 1 is a component 1, in particular a hybrid component for a carrier for arrangement between the A-pillars (not shown here in greater detail) of a motor vehicle (not shown here in greater detail).

The component 1 comprises, for example, a base body 2 formed from two connected elements E, which base body is lined with a film channel 3. The component 1 also comprises, for the ventilation of the interior of the vehicle, a plurality of openings O, which serve as air inlets and/or air outlets. An opening O for the supply of air from an air conditioning system and/or heating and an opening O for a central outlet opening are provided in the central area. Openings O for the outer outlet nozzles are present at the ends of the carrier 1.

The film channel 3 serves as a flow channel for the purpose, for example, of conducting air or routing cables. The film channel 3 is in the form of a foamed or extruded polypropylene foam film in one possible embodiment. The film channel 3 preferably exhibits a

wall thickness of 0.4 mm to 0.5 mm for a density of 60 g/l to 200 g/l or 300 g/l. In addition, the film channel 3 can be provided with a thermally insulated covering layer.

The base body 2 is preferably made from a metal sheet, in particular a light metal sheet, for example from aluminum sheet, magnesium sheet, or fine steel sheet. The base body 2 in the illustrative embodiment is executed as a hollow profile, and in particular as a tubular hollow profile. Alternatively, the base body can also be executed as a hollow profile with a box-like cross section. In this case, one of the elements E of the base body 2 forms a U-profile or a half shell or an under shell, and the other element E is executed as a lid. The base body 2 exhibits a wall thickness of 0.7 mm to 1.2 mm. The base body 2 can be provided internally with plastic in addition. The plastic is attached in the form of a plastic lining by joining, insertion or extrusion.

In order to permit the best possible utilization of the film channel 3 for guiding a medium, for example air, for the air conditioning of a vehicle interior or, alternatively, for routing lines or cables, the two elements E must be secured to one another sufficiently via the edges R. The edges R in this case form the parting plane between two elements E. For this purpose, with the base body 2 in its closed state, the elements E are attached to one another at their edges R that are superimposed one on top of the other by mechanical means and/or with positive bonding between the materials. To this end, the base body 2 can be attached by caulking to the mutually opposing edges R of the elements E by riveting, screwing, welding, gluing, folding, caulking, clinching or in some other way. In addition, the base body 2, and in particular its two elements E, can be held together via the plastic at the

edges R at openings, for example projections, that are not illustrated here in greater detail.

The plastic lining on the internal wall formed from the plastic serves the purpose, among other things, of increasing the rigidity of the base body 2. When air flows through it, the base body 2 of particularly thin-walled execution gives rise to the generation of noise, which is damped to particularly great advantage by lining the base body 2 with the plastic. That is to say, the plastic assumes an acoustic insulation function and, if appropriate, a thermal insulation function, too.

Figures 2A, 2B and 2C illustrate the so-called Twin Sheet process. This involves clamping two flat layers 8 of plastic or plastic films in place in a separate forming tool 7 with a cavity H for the purpose of forming and producing the film channel 3. Polypropylene foam films or polyethylene foam films, for example, are clamped in place as layers of plastic. The layers 8 of plastic are attached to one another at their edges R by means of connecting elements 9, for example by screwing, compressing or welding. The forming tool 7 exhibits a plurality of recesses 10 in the form of longitudinal bores, through which from the outside, for example, a negative pressure can be applied, which acts on the internal space (= cavity H) of the forming tool 7. A grille 11 is arranged on the internal wall of the cavity H of the forming tool 7.

The layers 8 of plastic in Figure 2A are pre-heated, whereby they are caused to adopt a dough-like consistency and become ductile. Warm or hot air is then blown in between the two layers 8 of plastic and a positive pressure is thereby created. The layers 8 of plastic are caused to arch outwards by means of the positive pressure that is applied externally via the

recesses 10, as shown in Figure 2B, and are forced or sucked into the mutually opposing cavities in the forming tool 7.

The process is allowed to continue until the layers 8 of plastic arch outwards as far as the internal wall of the forming tool 7, as shown in Figure 2C. Any expansion into the recesses 10 is prevented by the grille 11. The nature of the material of the forming tool 7 is such that no adhesion takes place with the film material. After cooling and opening the forming tool 7 and removal of the clamping devices, the sufficient inherent rigidity of the layer 8 of plastic retains its shape of a channel which forms the film channel 3 of the component 1, as represented in Figure 2D. The layers 8 of plastic may be compact, foamed and/or single-layer and/or multiple-layer formed bodies. A blown film can also be utilized.

In order to avoid sagging of the film channel 3, additional reinforcing elements may be applied to the film, for example adhesive strips, which additionally bring about adhesion to the internal wall of the base body 2. Alternatively or additionally, thin strips of a stronger plastic or a textile sheet material may be used.

Instead of using positive pressure and/or negative pressure to cause the film channel 3 to arch outwards, the attached edges R, for example the welded or also compressed film edges, may simply be pushed together. The arching of the plastic film or layer 8 in the cavities of the forming tool 7, in particular in its half shells, can be achieved in the same way by shortening spring elements applied to the layer 8 of plastic.

Figure 3A shows how the film channel 3 is introduced

into the elements E, for example two sheet metal half shells, of the base body 2. After joining together the elements E, the component 1, the hybrid carrier, is completed, and this stage is shown in Figure 3B. The film channel 3 is attached to the base body 2, for example by thermal adhesion to gluing points. Alternatively, the film channel 3 can be attached at its edge R by means of a securing element 12 on the edge of the base body 2, or can be attached to this by some other means.

As an alternative to a film channel 3 produced by the Twin Sheet process, the layers 8 of plastic can also be inserted into the elements E as two deep-drawn half shells made from compact thin plastic or from foamed plastic, and can be secured there. One or more additional plastic films or layers or deep-drawn layers can be inserted between these deep-drawn half shells, which subdivides the internal space of the film channel 3 into two or correspondingly more chambers.

Instead of prefabricating the film channel 3 in a separate forming tool 7, the foil channel 3 can be formed in the base body 2 itself. As illustrated in Figure 4A, along similar lines to the forming tool 7, two plastic films or layers 8 are clamped in the cavity H of the base body 2 and are attached at their edges R by means of connecting elements 9, for example by screwing or compression. The layers 8 of plastic are then preheated. Next, the outward arching of the layers 8 of plastic is brought about by positive pressure, as represented in Figure 4B. This is allowed to continue until the layers 8 of plastic are in contact with the elements E, as represented in Figure 4C. In conjunction with this, an adhesive effect of the plastic to the insides of the elements E is caused as a result of the heat, whereby a self-adhesive or adhesive fixing of the film channel 3 formed in this way is brought about.

Additional attachment by means of securing elements 12 is possible.

In a similar fashion to the forming tool 7, the elements E in this procedure can exhibit recesses so that, on the one hand, the uniform extension of the layers 8 of plastic is assured and, on the other hand, in addition to or as an alternative to the positive pressure, a negative pressure can be applied by the inward flow of warm air from the outside.

The film channel 3 is able, as an air-guiding channel, to conduct a flow of fresh air, cold air or warm air in order, for example, to bring about the drying or the rapid de-icing of a front screen in the event of condensation water being present in the channel.

It is fundamentally possible to cause a plurality of chambers or chamber channels to be formed inside the film channel 3, in which different media, for example fresh air, warm air, cold air are conducted, by a plurality of plastic films, which are expanded and/or formed in the corresponding geometrical relationships, or also by flat or deep-drawn plastic half shells.

Figure 5A illustrates in addition a component 1, in which the film channel 3 is completely arched outwards only in the direction of one of the elements E of the base body 2 and is joined to the internal wall. In the direction of the other element E, however, the outward arching is restricted by air flowing into the cavity H between the internal wall of the element E concerned and the film channel 3, so that, after the hardening of the plastic, a cavity H is formed between the internal wall of the element E concerned and the only partially outward-curved film channel 3, which can be used as an additional chamber K, that is to say as a guiding channel.

Figure 5B illustrated a base body 2 with a further film channel 3a, that is to say a plurality of film channels 3 and 3a are arranged in the base body 2. The film channel 3a is executed with adequately high inherent rigidity and a smaller cross section than that of the outer film channel 3. In addition, the elements E can be lined on the inside with plastic applied by spraying.

By spraying one of the elements E with compact or foamed plastic, while the other element E is lined with an elastic material or an elastic plastic shell, components such as holders, clips or seats can also be integrated, which are also capable of absorbing greater forces or other functions.

The film channels 3 can be used as a general rule not only in base bodies 2 with a closed hollow profile in the form of a hollow cylinder made of half shells, but also in any desired hollow profiles, in particular in U-profiles with a smooth lid.

The component 1 serves, for example, as an instrument panel carrier for an air conditioning and/or heating system. Alternatively, the component 1 can serve as a transverse member arranged under a windshield in a vehicle, which member is intended as an air-guiding channel for the air conditioning of the vehicle interior and for de-icing the windshield or front screen. The base body 2 is provided for this purpose with a plurality of flow taps arranged at a distance from one another viewed in the longitudinal direction with openings O for the inlet and/or outlet of a medium conducted in the film channel 3, for example air. The number and arrangement of the inlets and outlets can, of course, be varied at will. Moreover, an inlet or outlet can also be present in the vicinity of the edges

R and can extend both inside only one shell of the base body 2 and over both shells.

Furthermore, such a structural component 1 can also be used at other locations in a vehicle. Examples are: A-, B-, C-, D-pillars, longitudinal members, vehicle sills, roof components, etc. The air from an air conditioning system (abbreviated to HVAC) can also be conducted and distributed in a space-saving manner through these components 1, in conjunction with which the component 1 is executed as a structural component in the vehicle, and in particular as a hollow structural component.